AMENDMENTS TO THE SPECIFICATION

Amend the Title of the Invention to read as follows:

METHOD AND APPARATUS FOR BATTERY CHARGING WITH CONSTANT CURRENT, CONSTANT VOLTAGE, AND PULSED CHARGING

Amend paragraph [0004] to read as follows:

[0004] Thus, in order to avoid excessive charging voltage, the CCCV charging is generally used as the continuous charging method. In the CCCV charging method, charging with a constant current is performed at an early stage of the charging to the second battery and charging with a constant voltage is subsequently performed after a battery voltage of the second battery reaches a predetermined voltage. When the charging current (also referred to herein as "charge current" and "battery current") is reduced to a predetermined value, the second battery is in a fully-charged state and the charging is completed. One advantage of this method is the possibility of rapid charging by setting the charging current used in the constant current charging during the early stage of the charging to a relatively large value. Another advantage is the prevention of deterioration of the second battery due to application of excessive voltage since the charging mode is shifted from CC charging to CV charging when the battery voltage of the second battery reaches a predetermined voltage.

Delete paragraph [0016].

Amend paragraph [0020] to read as follows:

[0020] The current detecting circuit may include a resistor and a current detector. The resistor passes the charging ~~charge~~ current to be supplied to the second battery. The current detector detects the charging ~~charge~~ current based on a voltage across the resistor and outputs a signal in response to the detected charging ~~charge~~ current. In this case, the voltage detecting circuit, the current detector of the current detecting circuit,

the charge control circuit, the charge-end detecting circuit, and several components of the charging circuit including the constant voltage generating circuit, the voltage switching circuit, the constant current reference signal generating circuit, the signal switching circuit, and the voltage switching circuit are integrated into a single ~~signal~~ integrated circuit chip.

Amend paragraph [0021] as follows:

[0021] The current detecting circuit may include a resistor and a current detector. The resistor passes the charging ~~charge~~ current to be supplied to the second battery. The current detector detects the charging ~~charge~~ current based on a voltage across the resistor and outputs a signal in response to the detected charging ~~charge~~ current. In this case, the voltage detecting circuit, the current detector of the current detecting circuit, the charge control circuit, the charge-end detecting circuit, ~~the charge-end detecting circuit,~~ and several components of the charging circuit including the constant voltage generating circuit, the voltage switching circuit, the constant current reference signal generating circuit, the signal switching circuit, and the voltage switching circuit are integrated into a single ~~signal~~ integrated circuit chip.

Amend paragraph [0033] as follows:

Insert a new paragraph [0041.1] after paragraph [0041] as follows:

[0041.1] Several components shown in FIG. 1 can be integrated into a single IC (integrated circuit) chip, including the adapter circuit 2, the voltage detecting circuit 3, the current detecting circuit 6, the charge-end detecting circuit 7, the charge control circuit 8, and several components of the CCCV charging circuit 4 including the constant current reference signal generating circuit 21, the constant voltage generating circuit 22, the signal switching circuit 23, the voltage switching circuit 24, and the control circuit 26. In addition, the diode 27 can also be integrated into the above-mentioned single IC chip.

Amend paragraph [0046] to read as follows:

the time period T4. The constant current charge is performed following the completion of pulse charging and is completed upon an accurate detection of the full-charge. This constant current charge is the first half of the CCCV charging process.

Amend paragraph [0060] to read as follows:

[0060] Then, in Step S8, the charge control circuit 8 determines whether the battery voltage Vb is substantially equal to or greater than the third set voltage Vs3. The process of Step S8 continues until the battery voltage Vb is determined to be substantially equal to or greater than the third pre-set voltage Vs3. When the battery voltage Vb is determined to be substantially equal to or greater than the third pre-set voltage Vs3, the charge control circuit 8 performs the constant current ~~voltage~~ charge, in Step S9. That is, the charge control circuit 8 controls the signal switching circuit 23 to continue to output the second predetermined CCR signal S2 and the voltage switching circuit 24 to output the third predetermined constant voltage V3.

Delete paragraph [0062].

Insert paragraph [0066.1] as follows:

[0066.1] Several components shown in FIG. 4 can be integrated into a single IC (integrated circuit) chip, including the adapter circuit 2, the voltage detecting circuit 3, the current detecting circuit 6, the charge-end detecting circuit 7, the charge control circuit 108, and several components of the CCCV charging circuit 4 including the constant current reference signal generating circuit 21, the constant voltage generating circuit 22, the signal switching circuit 23, the voltage switching circuit 24, and the control circuit 26. In addition, the diode 27 can also be integrated into the above-mentioned single IC chip.

Amend paragraph [0068] to read as follows:

[0068] The charge control circuit 108 receives, from the adapter detecting circuit 2, a signal indicating an event that the AC adapter 10 applies power to the charging

apparatus 1 by being connected to the power source terminal 15. Then, the charge control circuit 108 starts the charge control at the time point Ts. The charge control circuit 108 controls the signal switching circuit 23 to output the first predetermined CCR signal S1 and also the voltage switching circuit 124 to output the first ~~third~~ predetermined constant voltage V1 ~~V3~~. Based on these actions, the control circuit 26 controls the operations of the control transistor 25 such that the battery voltage Vb indicated by the signal from the voltage detecting circuit 3 is substantially equal to the first ~~third~~ predetermined constant voltage V1 ~~V3~~ and such that the signal from the current detecting circuit 6 indicates that the charging current ib is substantially equal to the first predetermined constant current i1, so that pre-charging is performed relative to the lithium ion battery 11 during the time period T1.

Amend paragraph [0070] to read as follows:

[0070] Referring to FIGs. 6, 6A and 6B an exemplary procedure of the operation performed by the charge control circuit 108 is explained. The procedure of FIGs. 6, 6A and 6B is ~~are~~ similar to that shown in FIGs. 3, 3A and 3B, except for Steps S21 and S22 which replace Steps S2 and S4, respectively, shown in FIG. 3A.

Delete paragraph [0072].

Amend paragraph [0073] to read as follows:

[0073] In this way, the nonaqueous second charging apparatus 100 of FIG. 4 performs the charging operation similar to that of the charging apparatus 1 of FIG. 1, except for the above-described process in which the charging apparatus 100 causes the voltage switching circuit 124 to output the first constant voltage V1 during the time period T1 for the pre-charge process and the second constant voltage V2 during the time period T2 for the quick charge process. Therefore, in addition to the charging performance similar to that of the charging apparatus 1, the charging apparatus 100 has the following features: [[.]] That is, the control circuit 26 accurately controls the battery

voltage Vb to be no greater ~~become smaller~~ than the first constant voltage V1 in the pre-charge process (during time period T1) and also to be no greater ~~become smaller~~ than the second constant voltage V2 in the quick charge process (during time period T2). Therefore, it becomes possible to prevent a problem in that the pulse charge process erroneously starts before the pre-charge or the quick charge process is entirely completed if for any reason the battery voltage Vb is raised. For example, the above problem may occur when a nonaqueous second battery is discharged to an extent of an over discharge state, resulting in a deterioration of the battery. Also, this problem may cause a considerable loss of electric power to the control transistor, resulting in a production of a great amount of heat. However, the charging apparatus 100 having the above-described features can prevent these problems.